

fluid

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1 Flow past a cylinder

Let ρ_0 be the radius of the cylinder, ρ, ξ the polar coordinate system in use. One possible solution of this problem have these potential and streamline functions:

$$\phi(\rho, \xi) = \left(\rho + \frac{\rho_0^2}{\rho} \right) \cos \xi \quad (1)$$

$$\psi(\rho, \xi) = \left(\rho - \frac{\rho_0^2}{\rho} \right) \sin \xi \quad (2)$$

Although these equations are deeply coupled, the radius ρ and the phase ξ can be obtained as a function of the other quantities. For our purposes, we use ψ .

$$\rho(\psi, \xi) = \frac{\psi + \sqrt{\psi^2 + 4\rho_0^2 \sin^2 \xi}}{2 \sin \xi} \quad (3)$$

$$\xi(\psi, \rho) = \arcsin \left(\frac{\rho \psi}{\rho^2 - \rho_0^2} \right) \quad (4)$$

2 Conformal mapping

From the reference plane, which is equivalent to a two-pole machine, we use a complex map to obtain the quantities in the actual plane. Let p be

the number of pole pairs. Then:

$$\begin{aligned}\zeta &\xrightarrow{\mathcal{M}} z = \sqrt[p]{\zeta} \\ \rho e^{j\xi} &\xrightarrow{\mathcal{M}} r e^{j\vartheta} = \sqrt[p]{\rho} e^{j\xi/p} \\ \chi + j\eta &\xrightarrow{\mathcal{M}} x + jy\end{aligned}\tag{5}$$

It is easy to find the inverse map:

$$\mathcal{M}: \sqrt[p]{\cdot} \quad \mathcal{M}^{-1}: (\cdot)^p\tag{6}$$

3 Computation of flux-barrier base points

Let the flux-barrier and flux-carrier thicknesses be given. Then the base points for the flux-barriers can be computed easily.